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DRAFT

LANDSAT DATA CONTINUITY MISSION

OPERATIONAL LAND IMAGER (OLI) ACRONYM LIST AND LEXICON

April 18, 2005

National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

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LDCM PROJECT
DOCUMENT CHANGE RECORD

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REV LEVEL	DESCRIPTION OF CHANGE	APPROVED BY	DATE APPROVED
Draft September 28, 2004			

List of TBDs/TBRs

Item No.	Location	Summary	Ind./Org.	Due Date

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1.0 ACRONYM LIST

ABML	As-Built Materials List
ABPL	As-Built Parts List
ADF	Ancillary Data File
ADML	As-Designed Materials List
ADPL	As-Designed Parts List
ALI	Advanced Land Imager
ANSI	American National Standards Institute
AOS	Advanced Orbiting Systems
ASIC	Application Specific Integrated Circuits
ASQC	American Society for Quality Control
ASTM	American Society for Testing of Materials
BER	Bit Error Rate
BRDF	Bi-directional Reflectance Distribution Function
C&DH	Command and Data Handling
CADU	Channel Access Data Unit
CAGE	Commercial and Government Entity
CCF	Contamination Control Plan
CCP	Contamination Control Plan
CCSDS	Consultative Committee on Space Data Systems
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CFR	Code of Federal Regulations
CIL	Critical Items List
CM	Configuration Management
CN	Coherent Noise
CNDs	Could-Not-Duplicates
CO	Contracting Officer
COC	Certificate of Completion
COG	Center of Gravity
COTR	Contracting Officer's Technical Representative
COTS	Commercial Off-The-Shelf
CPT	Comprehensive Performance Test
CPU	Central Processing Unit
CRM	Continuous Risk Management
CTE	Calibration Test Equipment
CVCM	Collected Volatile Condensable Mass
DC	Direct Current
DCN	Documentation Change Notices
DID	Data Item Description
DM	Data Management
DN	Digital Number
DOD	Department of Defense

DOI	Department of the Interior
DPA	Destructive Physical Analysis
DRFP	Draft Request for Proposal
DSAP	Data Storage and Playback
DUNS	Data Universal Numbering System
EC	Electronic Copy
ECI	Earth Centered Inertial
EDAC	Error Detection and Correction
EDC	Earth Resources Observation Systems (EROS) Data Center
EDU	Engineering Development Unit
EEE	Electrical, Electronic, Electromechanical
EIA	Electronic Industry Alliance
ELV	Expendable Launch Vehicle
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EO-1	Earth Observer 1
EOL	End of Life
EOS	Earth Observing System
ESD	Electrostatic Discharge
ETM+	Enhanced Thematic Mapper Plus
EVP	Environmental Verification Plan
EVS	Earned Value System
EWP	Eastern and Western Test Ranges
FAR	Federal Acquisition Regulation
FDC	Failure Detection and Correction
FGDC	Federal Geographic Data Committee
FMEA	Failure Mode and Effects Analysis
FOR	Flight Operation Review
FOV	Field of View
FPA	Focal Plane Array
FPE	Focal Plane Electronics
FRB	Failure Review Board
FTA	Fault Tree Analysis
FWHM	Full Width Half Maximum
GAO	General Accounting Office
GDS	Ground Data Systems
GEVS	General Environmental Verification Specification
GFE	Government Furnished Equipment
GFY	Government Fiscal Year
GIA	Government Inspection Agency
GIDEP	Government Industry Data Exchange Program
GIID	General Instrument Interface Document
GOP	Ground Operations Plan
GPS	Global Positioning System
GSD	Ground Sample(ing) Distance

GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
HC	Hard Copy
HUB	Historically Underutilized Business
I&T	Integration and Test
IAC	Independent Assurance Contractor
IAS	Image Assessment System, Landsat 7
IC	International Cooperator
ICD	Interface Control Document
IDF	Image Data File
IOC	Initial Operational Capability
IPC	Institute for Interconnecting and Packaging Electronic Circuits
IPSR	Instrument Pre-Ship Review
IRD	Interface Requirements Document
IRU	Inertial Reference Unit
ISO	International Organization for Standardization
ITAR	International Traffic in Arms Regulations
IV&V	Independent Verification and Validation
KHB	Kennedy Space Center Handbook
Lmax	Maximum Radiance
Ltypical	Typical Radiance
LDCM	Landsat Data Continuity Mission
LMST	Local Mean Solar Time
LOS	Line of Sight
LPT	Limited Performance Test
LRR	Launch Readiness Review
LTAP	Long Term Acquisition Plan
M&PCB	Materials and Processes Control Board
M&PCP	Materials and Processes Control Program
MAE	Materials Assurance Engineer
MAR	Mission Assurance Requirements
MCM	Multi-Chip Module
MEB	Materials Engineering Branch
MIL	Materials Identification List
MODIS	Moderate Resolution Imaging Spectrometer
MODTRAN	Moderate Resolution Transmittance
MOI	Moment of Inertia
MOR	Mission Operations Review
MPR	Monthly Progress Review
MPSR	Management Program Status Review
MRB	Material Review Board
MSFC	Marshall Space Flight Center
MSPSP	Missile System Prelaunch Safety Data Package
MUA	Materials Usage Agreement
NAS	NASA Assurance Standard

NASA	National Aeronautics and Space Administration
NASCOM	NASA Communications Network
NASDA	National Space Development Agency of Japan
NDE	Non-Destructive Examination
NDVI	Normalized Difference Vegetation Index
NEPAG	NASA EEE Parts Assurance Group
NHB	NASA Handbook
NIR	Near Infrared
NIST	National Institute of Standards and Technology
NPD	NASA Policy Directive
NPOESS	National Polar Operational Environmental Satellite System
NPSL	NASA Parts Selection List
NRCA	Nonconformance Reporting and Corrective Action
NSPAR	Nonstandard Parts Approval Request
NSS	NASA Safety Standard
NTE	Not To Exceed
NUC	Non-Uniformity Correction
OBP	On-Board Processor
OLI	Operational Land Imager
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration
OSSMA	GSFC Office of Systems Safety and Mission Assurance
PAPL	Project Approved Parts List
PCB	Parts Control Board
PCP	Parts Control Plan
PDL	Product Design Lead
PDR	Preliminary Design Review
PER	Performance Evaluation Review; Pre-Environmental review
PF	Polarization Factor
PFR	Problem / Failure Report
PI	Principal Investigator
PIL	Parts Identification List
PM	Program Management
POCC	Payload Operations Control Center
PPL	Preferred Parts List
PR	Program Review
PRA	Probabilistic Risk Assessment
PSD	Power Spectral Density
PSM	Project Safety Manager
PSR	Program Status Review; Pre-Shipment Review
PWB	Printed Wiring Board
QA	Quality Assurance
QCM	Quartz Crystal Microbalance
QMS	Quality Management System
RBS	Reflective Band Sensor

RF	Radio frequency
RFP	Request for Proposal
ROI	Return on Investment
SAM	Systems Assurance Manager
SC	Spacecraft
SCC	Stress Corrosion Cracking
SCM	Software Configuration Management
SCR	System Concept Review
SDMP	Software Development and Management Plan
SE	Systems Engineering
SEU	Single Event Upset
SI	Science Instrument
SMA	Safety and Mission Assurance
SMD	Stored Mission Data
SNR	Signal to Noise Ratio
SOW	Statement of Work
SPSR	System Pre-Ship Review
SPVP	System Performance Verification Plan
SQA	Software Quality Assurance
SQMS	Software Quality Management System
SR	System Review
SRO	Systems Review Office
SRR	System Requirements Review
SRT	Systems Review Team
SSIP	System Safety Implementation Plan
STE	System Test Equipment
STM	Structural Thermal Model
SW	Software
SWIR	Short Wave Infrared
TBC	To Be Confirmed
TBD	To Be Determined
TBR	To Be Reviewed
TBS	To Be Supplied
TDI	Time Delay Integration
TID	Total Incidence Dose
TIM	Technical Interface Meeting
TIRS	Thermal Infrared Sensor
TML	Total Mass Loss
TQCM	Temperature Controlled Quartz Crystal Microbalance
T/V	Thermal/Vacuum
USG	United States Government
USGS	United States Geological Survey
V&V	Verification and Validation
VNIR	Visible and Near Infrared
VTL	Verification Tracking Log

WBS	Work Breakdown Structure
WGS84	World Geodetic System 1984

2.0 LEXICON

Ancillary Data - Ancillary Data consist of satellite and sensor housekeeping data, calibration data and any other supplementary data required to generate the specified higher-level validation data products. Ancillary data typically include relevant instrument parameters, spacecraft attitude and ephemeris, etc.

Auxiliary Data – NJS define

Audit - A review of the developers, contractor's or subcontractor's documentation or hardware to verify that it complies with project requirements.

Azimuth - Angle measured in the ecliptic or equatorial plane as part of a spherical polar coordinate system (radius or altitude, azimuth and elevation).

Bi-directional Reflectance Distribution Function (BRDF) - A function that expresses reflectance from a surface into a unit projected solid angle as a function of both the direction of illumination and the direction of observation.

Bright Target Recovery - The recovery of the system from a saturation event such as a sun glint.

Calibration - the process of adjusting or normalizing to a standard. Calibration is performed to determine correction parameters (e.g. gains and offsets) that can be applied to the data to correct for systematic errors.

Coherent Noise - A spurious, periodic pattern of noise within an image, generally of electronic origin.

Collected Volatile Condensable Material (CVCM) - The quantity of outgassed matter from a test specimen that condenses on a collector maintained at a specific constant temperature for a specified time.

Dark Detectors - Detectors on the focal plane of the instrument that are masked from receiving all incoming light, but are otherwise identical to the detectors observing the Earth reflected radiation. Typically these will be detectors at the ends of the sensor chip arrays (SCA's)

Dead Pixels – See Inoperable Pixels

Detector column - A set of physical detectors imaging the same spatial locations for a single band, which are treated as a single sensing element by having their outputs combined in time-delay integration (TDI).

Digital Image Data - Two-dimensional arrays of digital numbers, one per spectral band, representing a remotely sensed surface.

Digital Number (DN) - The radiance seen by the detector at each pixel converted to an electrical signal and then quantized to a discrete integer value.

Discrepancy - Refer to Nonconformance

Dynamic Range - The range of radiances over which instruments and sensors are sensitive. The upper end of the dynamic range is the saturation radiance. The lower end is the noise floor, i.e., the radiance corresponding to the low radiance noise level of the instrument. These radiances may be expressed as equivalent blackbody temperatures for thermal bands.

Edge Response - The response of an imaging system to an edge target (i.e., a low/high or high/low step function), normalized so that the mean response on the low side of the edge target is set to zero and the mean response on the high side of the edge target is set to 100%.

Ephemeris Data - A set of data that provides the assigned places of a celestial body (including a manmade satellite) for regular intervals. Ephemeris data helps to characterize the conditions under which remote sensing data are collected and may be used to correct the sensor data prior to analysis.

Failure Modes and Effects Analysis (FMEA) - A procedure by which each credible failure mode of each item from a low indenture level to the highest is analyzed to determine the effects on the system and to classify each potential failure mode in accordance with the severity of its effect.

Federal Geographic Data Committee (FGDC) - Established by the Office of Management and Budget for purposes of coordinating the development, use, sharing and dissemination of geographic data.

Field of View – The angular extent of the region from which a sensor can collect data without changing location. This can be applied to either the sensor as a whole or to individual detector elements in which case it is referred to as the instantaneous field of view (IFOV).

Geodetic Reference System - A comprehensive geodetic model of the Earth including a geodetic reference frame, a best-fit Earth ellipsoid/spheroid model, and an Earth gravitational model. The inclusion of all these components allows a geodetic reference system to serve as a horizontal and vertical datum. The standard LDCM geodetic reference system is the World Geodetic System 1984 (WGS84).

Ghost Image - A secondary image of an object, which appears as either an attenuated rendition of the original object or a blurred and attenuated version of the original object. A “Ghost" also has a constant displacement vector from the original image. A significant "Ghost" is defined as an image artifact when its peak signal after background level subtraction and radiometric calibration is above 1% (TBR) of the peak signal in the original object and above the "white" noise (random noise) level.

Ground Sample Distance (GSD) - The distance on the ground between adjacent image sample (pixel) centers.

Image Compression - The process of reducing the amount of data required to represent the information present within an image.

Imax - The maximum response of an instrument as a polarizer analyzer is rotated.

Imin - The minimum response of an instrument as a polarizer analyzer is rotated.

Inoperable Detector - A detector that does not meet the definition of operable detector (see **Operable Detector**).

Inoperable Pixel - A pixel is considered dead or inoperable if greater than 50% of its ground projected area is not imaged by operable detectors.

Jitter - High frequency variations in sensor position and/or angular orientation leading to deviations in the actual sensor line of sight relative to the ideal line of sight over time periods up to a few seconds. Usually induced by mechanical vibrations from external disturbances or internal mechanisms.

Lossless Compression – A data compression process such that the data, after compression and decompression, is identical numerically to the data prior to compression

Modulation Transfer Function Compensation (MTFC) Resampling - The modulation transfer function compensation resampling technique assigns a value to each output (resampled) pixel, computed as a weighted combination of the surrounding input pixels. The input pixel value weights are computed based on the output pixel location relative to the surrounding input pixels, using an interpolation function with a spatial frequency response that has been designed to compensate for the spatial frequency attenuation characteristics of the imaging system's modulation transfer function.

Nadir - That point on the celestial sphere vertically below the observer, or 180^{o} from the zenith.

Near Infrared - The spectral region covering 700-1000 nm.

Non-uniformity Correction – Non-uniformity correction (NUC): The process of performing a reversible on-board relative correction of gain and offset for each pixel to reduce the entropy of a scene to improve data compressibility and/or reduce errors in on-board aggregation or resampling.

Operable Detector - A detector is considered operable, even if out of spec, if it meets the following requirements:

a. The detector shall be sensitive to photons within its spectral band and not be saturated at expected operating temperatures under dark conditions.

b. The detector's noise shall be less than 5 times the mean noise level for the band on which it occurs.

c. The detector's dark current shall remain within +/- 5 times the RMS noise over the period between dark frame references.

d. The detector's dynamic range shall be **no?** greater than 25% of the specified dynamic range.

Optical Axes - The X, Y, and Z axes of the Cartesian coordinate system that aligns its positive Z-axis with the vector of the Optical Axis of the telescope optical system traveling from the focal plane towards the objective mirror of the telescope. The Optical Axes form a right-handed coordinate system with the X-axis normal to the line formed by the detectors in each band, and its positive direction is defined to be towards the leading spectral band (the first band that images a ground target object). The Y-axis is constructed as the cross product of the Z-axis and the X-axis.

Outgassing - The emanation of volatile materials under vacuum conditions resulting in a mass loss and/or material condensation on nearby surfaces.

Pixel – Short for "picture element", it is the smallest discrete piece of image data in an image and corresponds to a single spatial sample.

Polarization Factor (PF) - The modulation ratio PF = (Imax-Imin)/(Imax+Imin) associated with a polarization sensitivity measurement.

Polarization Sensitivity - The sensitivity of the system to changes in the polarization of the signal.

Reflective Band Sensor Data – Reflective Band Sensor Data are the originally measured detector or detector column output counts at the native spatial and spectral possibly adjusted by reversible offset and scale corrections. Offset and scale correction reversibility implies that the relationship between the original detector counts and the remapped data counts is one-to-one for all measured detector output values.

Relative Response - Within the context of the specifications for the LDCM Spectral Bands, the term Relative Response has the same definition as the Relative Spectral Radiance Response Curve.

Relative Spectral Radiance Response Curve – Is a normalized (unitless) function of Spectral Radiometric Sensitivity divided by the peak in-band Spectral Radiometric Sensitivity. The resultant data plotted against wavelength generally appears to be a continuous smoothly varying

function or “curve”. This is an instrument-level response (can have a filter-level spectral response curve, too) that incorporates the optical transmission of the telescope and optical bandpass filters, and the photon detector’s radiance responsivity.

Scattered Light - Undesired light contamination projected on a focal plane caused primarily by uneven surface features on optical surfaces. This optical surface roughness is usually measured by performing a BRDF measurement for each optical surface.

Scene – Definition TBS

Sharpening Band - Single spectral band that may have a finer spatial resolution than the other bands, usually in an integer multiple, which allows for sharpening of the multispectral bands.

Signal-to-Noise-Ratio (SNR) - The ratio of the level of the information-bearing signal power to the level of the noise power. More precisely, the signal-to-noise ratio of the mean digital number (DN) to the standard deviation in DN. This is a temporal noise definition in that the mean DN is the time averaged value and the standard deviation in DN is the standard deviation in the time series.

Spectral Band - An interval in the electromagnetic spectrum commonly designated by a spectral bandwidth and a center wavelength.

Spectral Band Center Wavelength – A wavelength within a spectral band, halfway between the lower and upper band edges.

Spectral Bandwidth - The wavelength interval between the lower and upper band edges. The lower band edge is the lowest wavelength where the relative spectral radiance response is 50% of the peak response. The upper band edge is the highest wavelength where the relative spectral radiance response is 50% of the peak response.

Stray Light - Light scattered onto a detector from areas outside a specified solid angle.

Streaking Parameter - The streaking parameter is defined by the following equation:

$$S_i = \left| L_i - \frac{1}{2}\left(L_{i-1} + L_{i+1}\right) \right| / L_i$$

(Note: factor of 100 was removed per Lencioni comment – need confirmation that this is correct.)

where

L_i is the calibrated radiance value measured for a pixel at an input radiance level;

L_{i-1} and L_{i+1} are similarly defined for the $(i-1)^{th}$ and $(i+1)^{th}$ pixels.

Swath - The strip on the Earth that the instrument observes as it passes overhead.

Viewing Geometry -The viewing geometry for which the data shall be acquired, characterized by the zenith and azimuth angles from a ground point to the sensor at the time of observation.

Visible - The spectral region covering 400-700 nm.

Wideband Data - The downlinked data containing LDCM sensor data and ancillary data that have been processed and formatted for efficient data transmission. Examples of wideband data processing steps for LDCM purposes include lossless compression, error detection and correction coding, pseudo-noise encoding, etc. Examples of wideband data formatting include packet and frame-level organization of the LDCM sensor and ancillary data.

World Geodetic System 1984 (WGS84) - A global geodetic reference system defined and maintained by the National Imagery and Mapping Agency (NIMA). WGS84 is the standard geodetic reference system for LDCM. For remote sensing applications such as LDCM, WGS84 can be considered to be functionally equivalent to the International Terrestrial Reference System (ITRS) and its International Terrestrial Reference Frame (ITRF) realizations.

Zenith - The point in the celestial sphere that is exactly overhead.

Zenith Angle - The angle between the sun and the zenith for a given position on the Earth's surface. Also, the complement of the angle between the horizon and the sun (solar elevation).